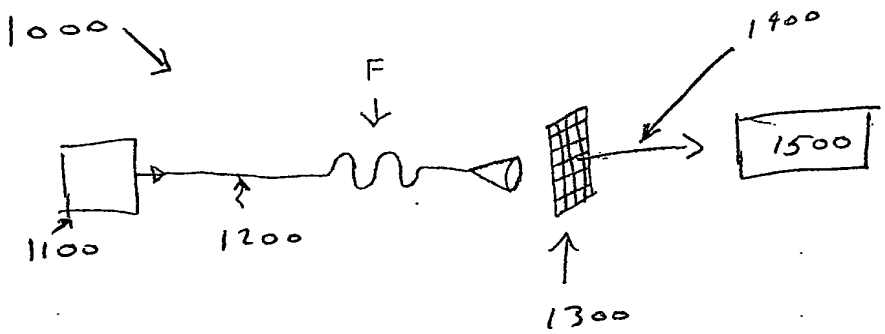

1000
F
1400
1500
1100
1200
1300

FIG. 1

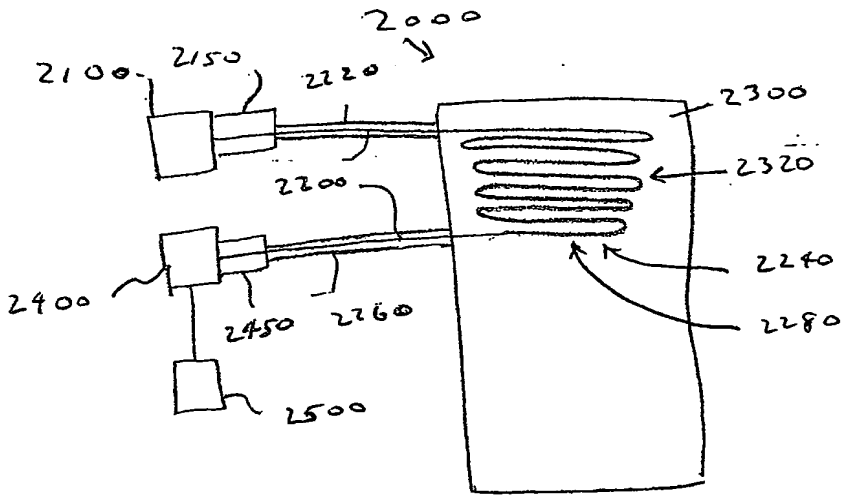

2000
2100
2150
2220
2300
2320
2200
2240
2400
2450
2260
2280
2500

FIG. 2.

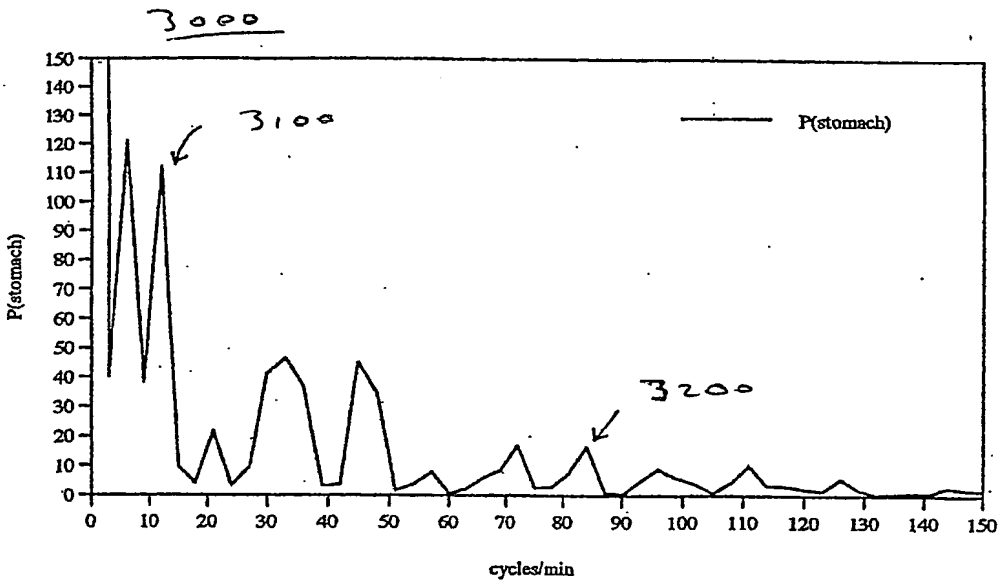

3000
3100
3200
P(stomach)
P(stomach)
cycles/min
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

FIG. 3

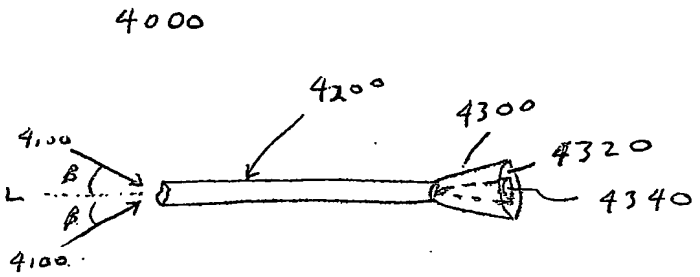

4000
4200
4300
4320
4340
4100
β
L
β
4100

Fig. 4

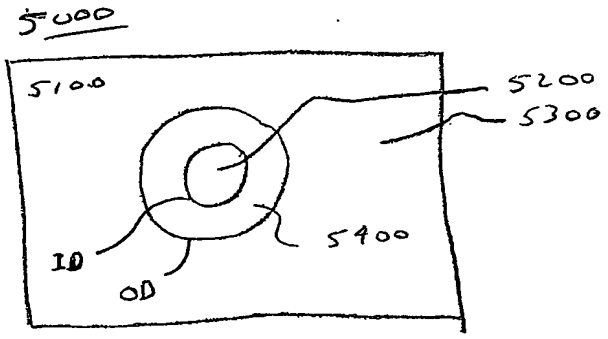

5000
5100
5200
5300
5400
ID
OD

Fig. 5

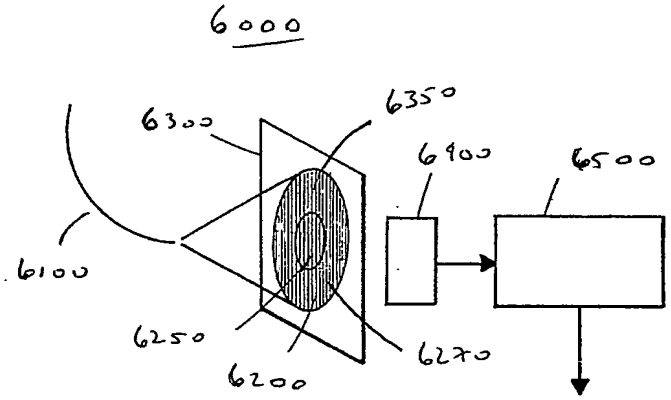

6000
6350
6300
6400
6500
6100
6250
6270
6200

FIG. 6

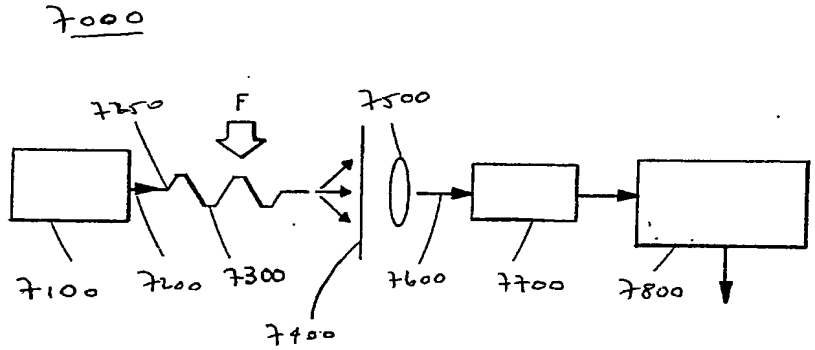

7000
7250
F
7500
7100
7200
7300
7600
7700
7800
7400

FIG. 7

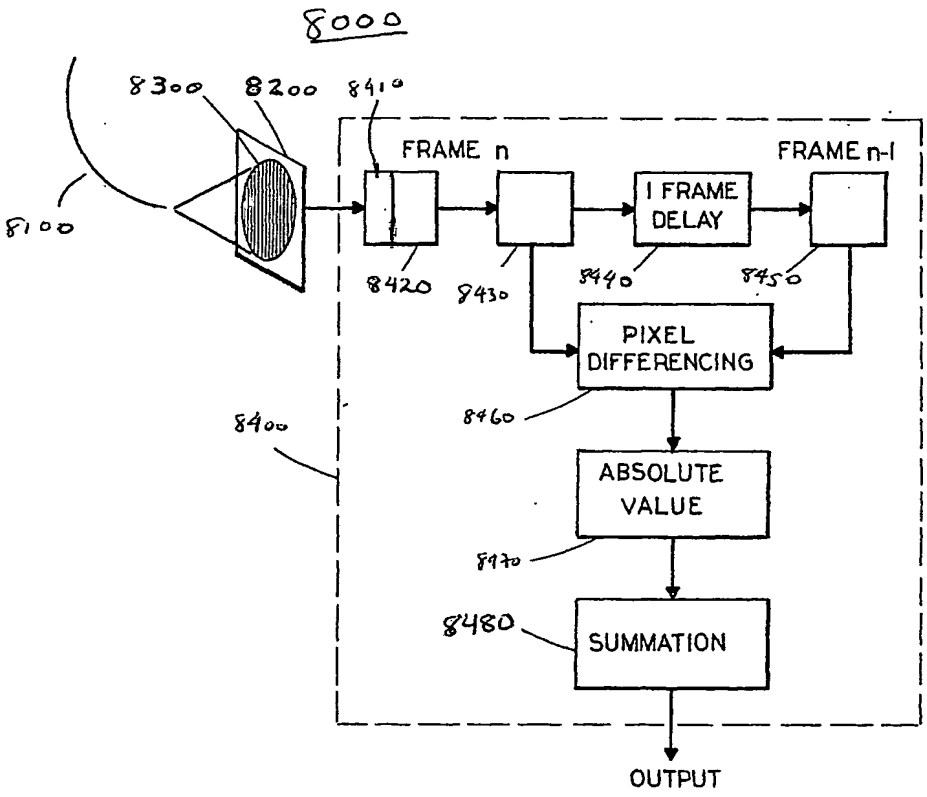

8000
8300
8200
8410
8100
FRAME n
FRAME n-1
I FRAME DELAY
8420
8430
8440
8450
PIXEL DIFFERENCING
8460
8400
ABSOLUTE VALUE
8470
8480
SUMMATION
OUTPUT

Fig. 8

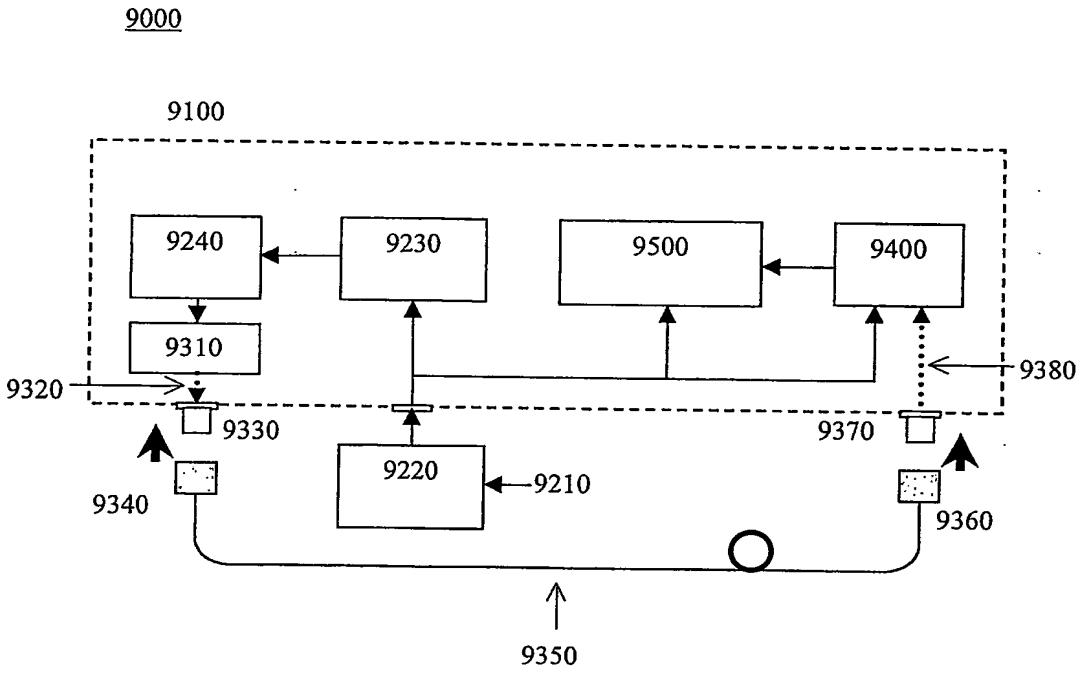

9000
9100
9240
9230
9500
9400
9310
9320
9380
9330
9370
9220
9210
9340
9360
9350

FIG. 9

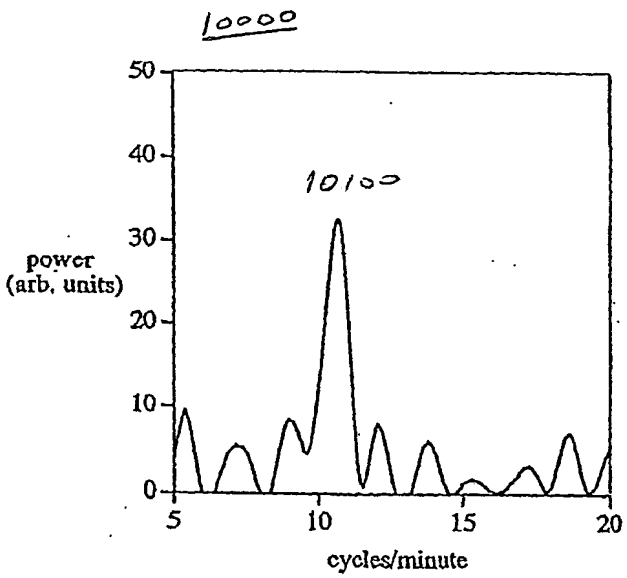

10000
50
40
10100
30
power
(arb. units)
20
10
0
5
10
15
20
cycles/minute

FIG. 10

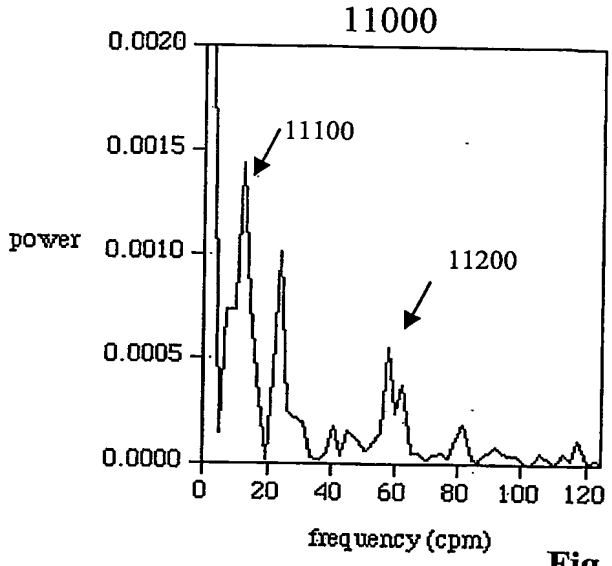

11000
0.0020
0.0015
0.0010
0.0005
0.0000
power
11100
11200
0
20
40
60
80
100
120
frequency (cpm)

Fig. 11

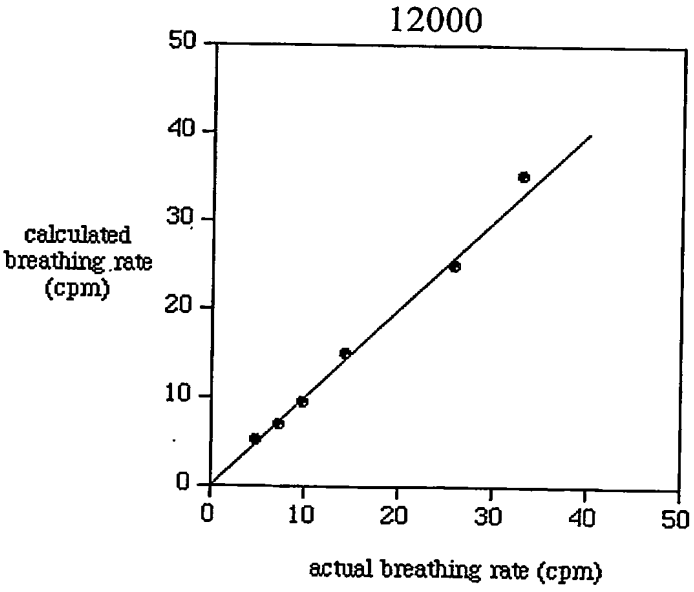

12000
50
40
30
20
10
0
calculated breathing rate (cpm)
0
10
20
30
40
50
actual breathing rate (cpm)

Fig. 12

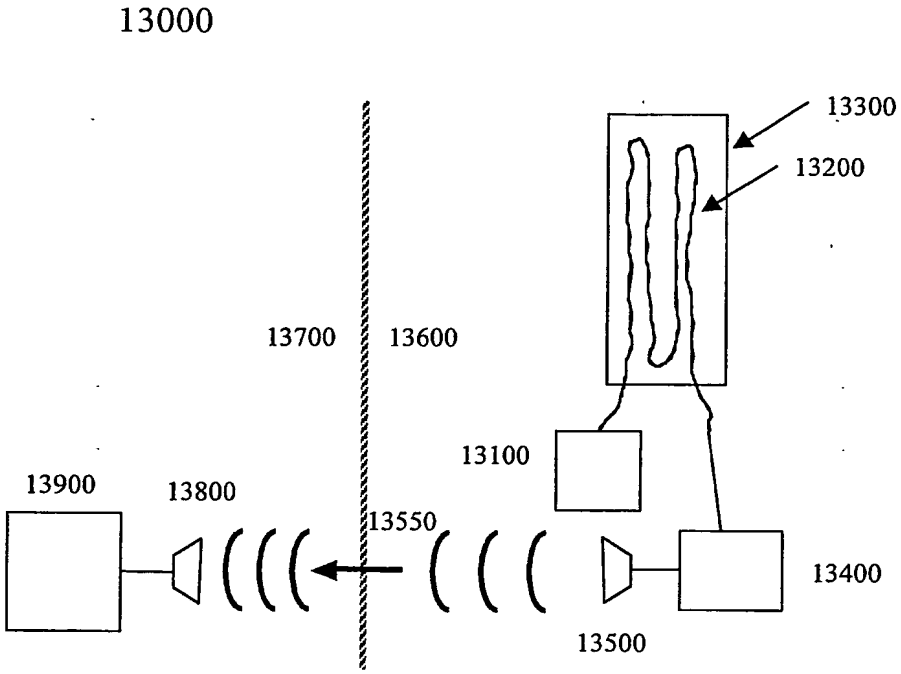

13000
13300
13200
13700
13600
13100
13900
13800
13550
13400
13500

Fig. 13

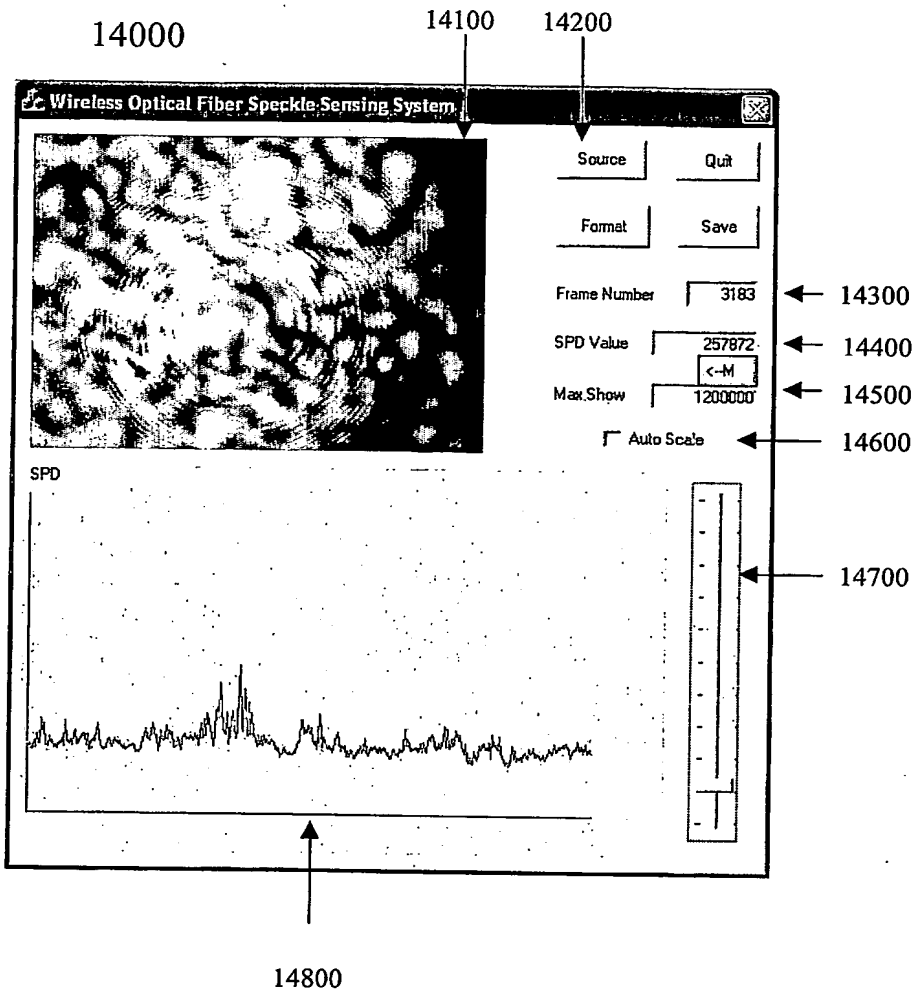

14000
14100
14200
Wireless Optical Fiber Speckle Sensing System
Source
Quit
Format
Save
Frame Number
3183
14300
SPD Value
257872
14400
<-M
Max Show
1200000
14500
Auto Scale
14600
SPD
14700
14800

Fig. 14

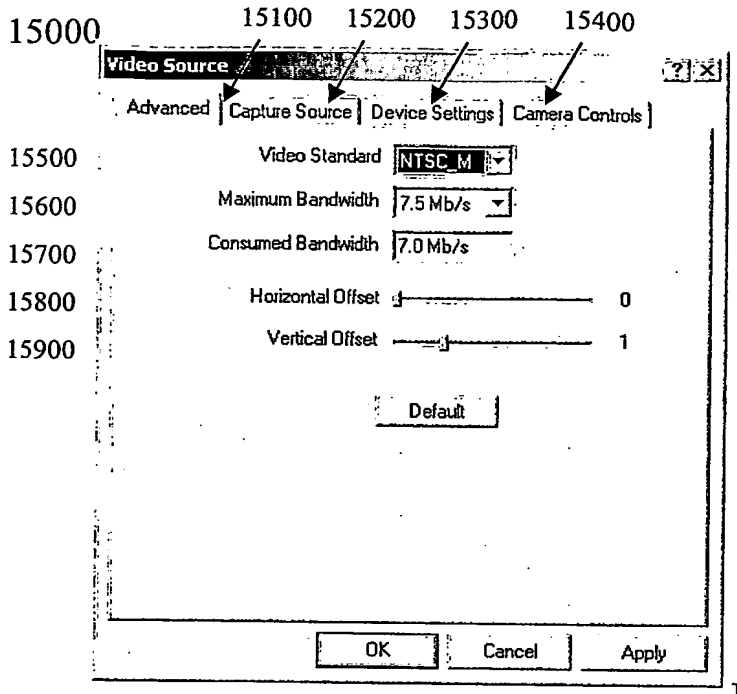

15000
15100
15200
15300
15400
Video Source
Advanced
Capture Source
Device Settings
Camera Controls
15500
Video Standard
NTSC_M
15600
Maximum Bandwidth
7.5 Mb/s
15700
Consumed Bandwidth
7.0 Mb/s
15800
Horizontal Offset
0
15900
Vertical Offset
1
Default
OK
Cancel
Apply

Fig. 15

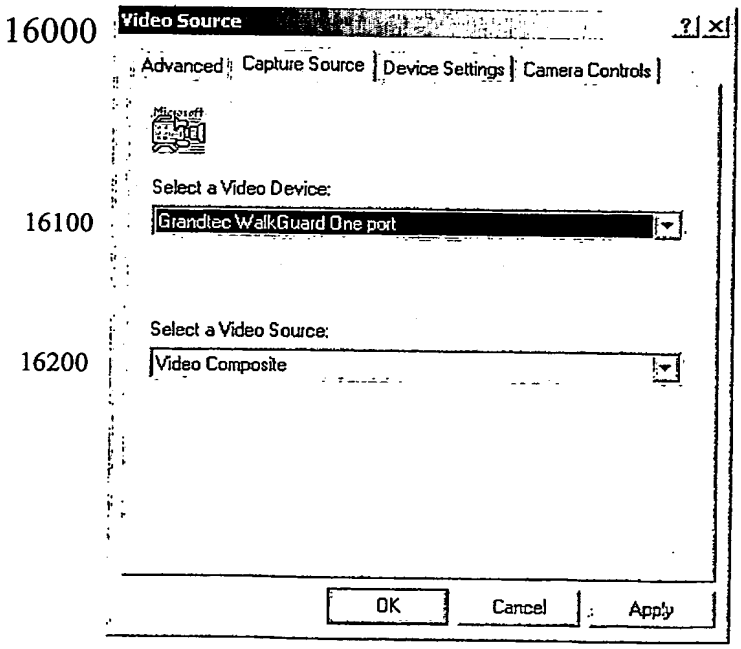

16000
Video Source
Advanced
Capture Source
Device Settings
Camera Controls
Select a Video Device:
16100
Grandtec WalkGuard One port
Select a Video Source:
16200
Video Composite
OK
Cancel
Apply

Fig. 16

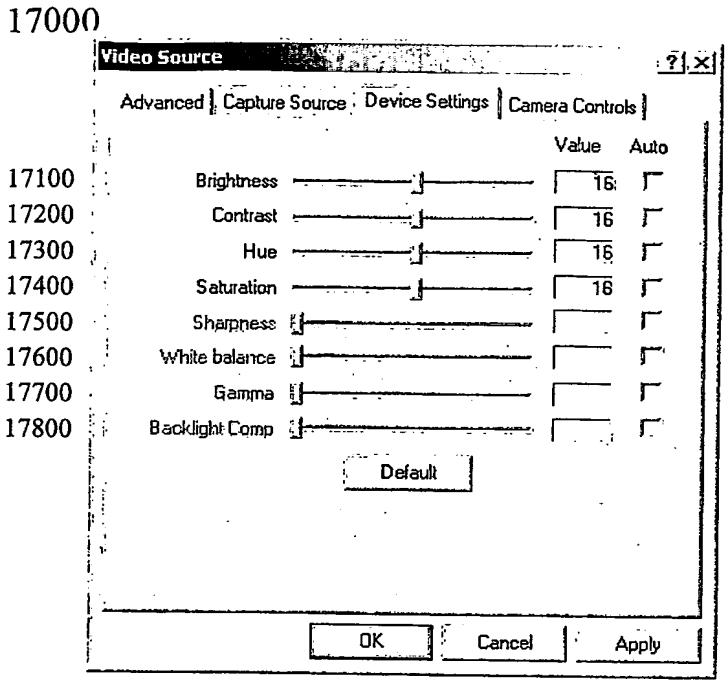

17000
Video Source
Advanced
Capture Source
Device Settings
Camera Controls
Value
Auto
17100
Brightness
16
17200
Contrast
16
17300
Hue
16
17400
Saturation
16
17500
Sharpness
17600
White balance
17700
Gamma
17800
Backlight Comp
Default
OK
Cancel
Apply

Fig. 17

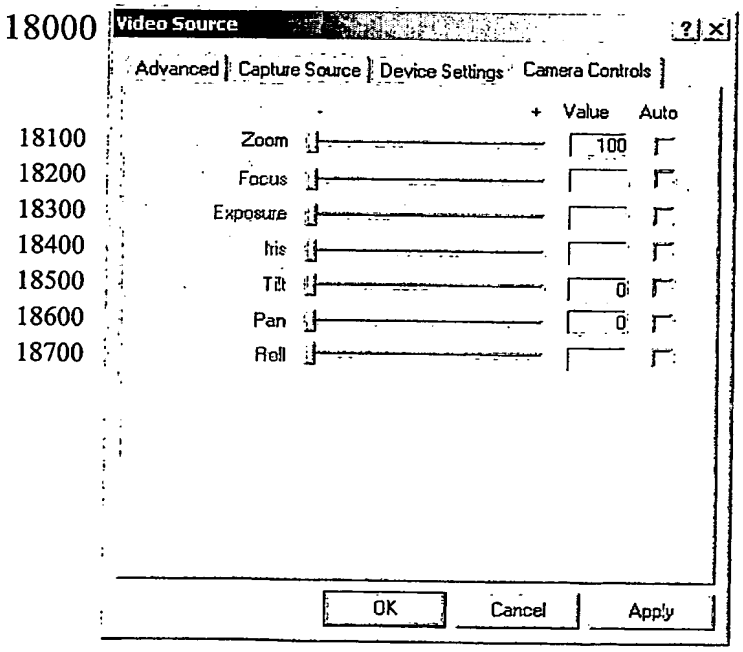

18000
Video Source
Advanced
Capture Source
Device Settings
Camera Controls
-
+
Value
Auto
18100
Zoom
100
18200
Focus
18300
Exposure
18400
Iris
18500
Tilt
0
18600
Pan
0
18700
Roll
OK
Cancel
Apply

Fig. 18

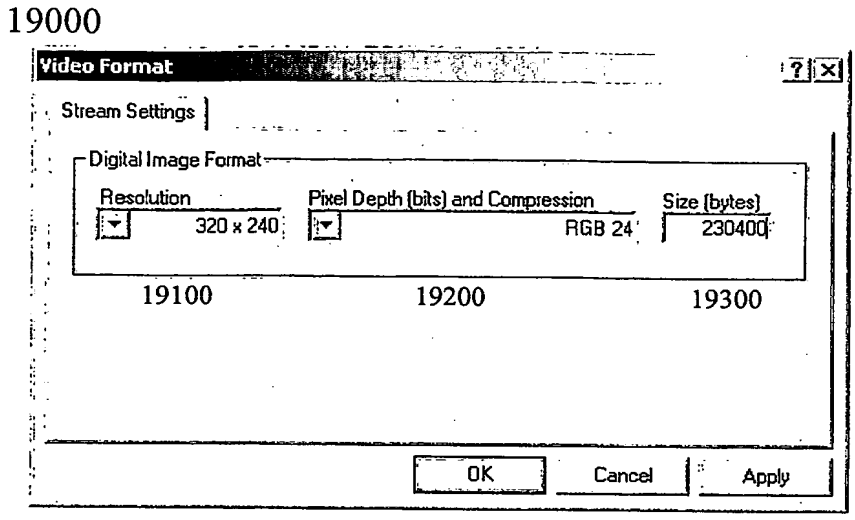
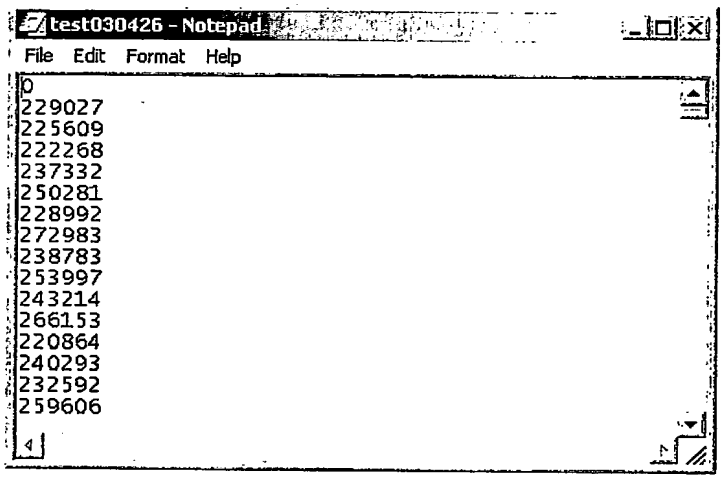

19000
Video Format
Stream Settings
Digital Image Format
Resolution
320 x 240
Pixel Depth (bits) and Compression
RGB 24
Size (bytes)
230400
19100
19200
19300
OK
Cancel
Apply

Fig. 19

20000



20100

Fig. 20

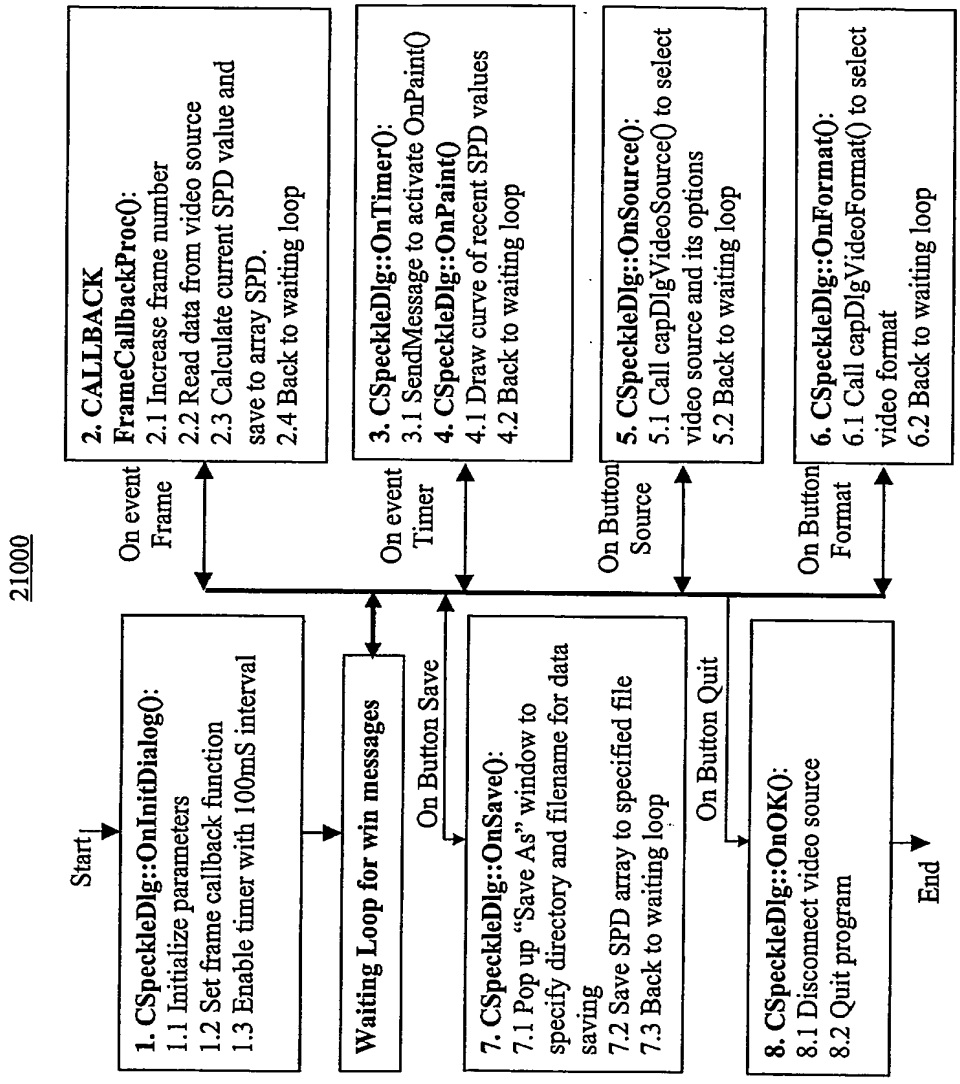

21000
Start
1. CSpeckleDlg::OnInitDialog():
1.1 Initialize parameters
1.2 Set frame callback function
1.3 Enable timer with 100mS interval
Waiting Loop for win messages
On event Frame
2. CALLBACK FrameCallbackProc():
2.1 Increase frame number
2.2 Read data from video source
2.3 Calculate current SPD value and save to array SPD.
2.4 Back to waiting loop
On event Timer
3. CSpeckleDlg::OnTimer():
3.1 SendMessage to activate OnPaint()
4. CSpeckleDlg::OnPaint()
4.1 Draw curve of recent SPD values
4.2 Back to waiting loop
On Button Source
5. CSpeckleDlg::OnSource():
5.1 Call capDlgVideoSource() to select video source and its options
5.2 Back to waiting loop
On Button Format
6. CSpeckleDlg::OnFormat():
6.1 Call capDlgVideoFormat() to select video format
6.2 Back to waiting loop
On Button Save
7. CSpeckleDlg::OnSave():
7.1 Pop up "Save As" window to specify directory and filename for data saving
7.2 Save SPD array to specified file
7.3 Back to waiting loop
On Button Quit
8. CSpeckleDlg::OnOK():
8.1 Disconnect video source
8.2 Quit program
End

FIG. 21

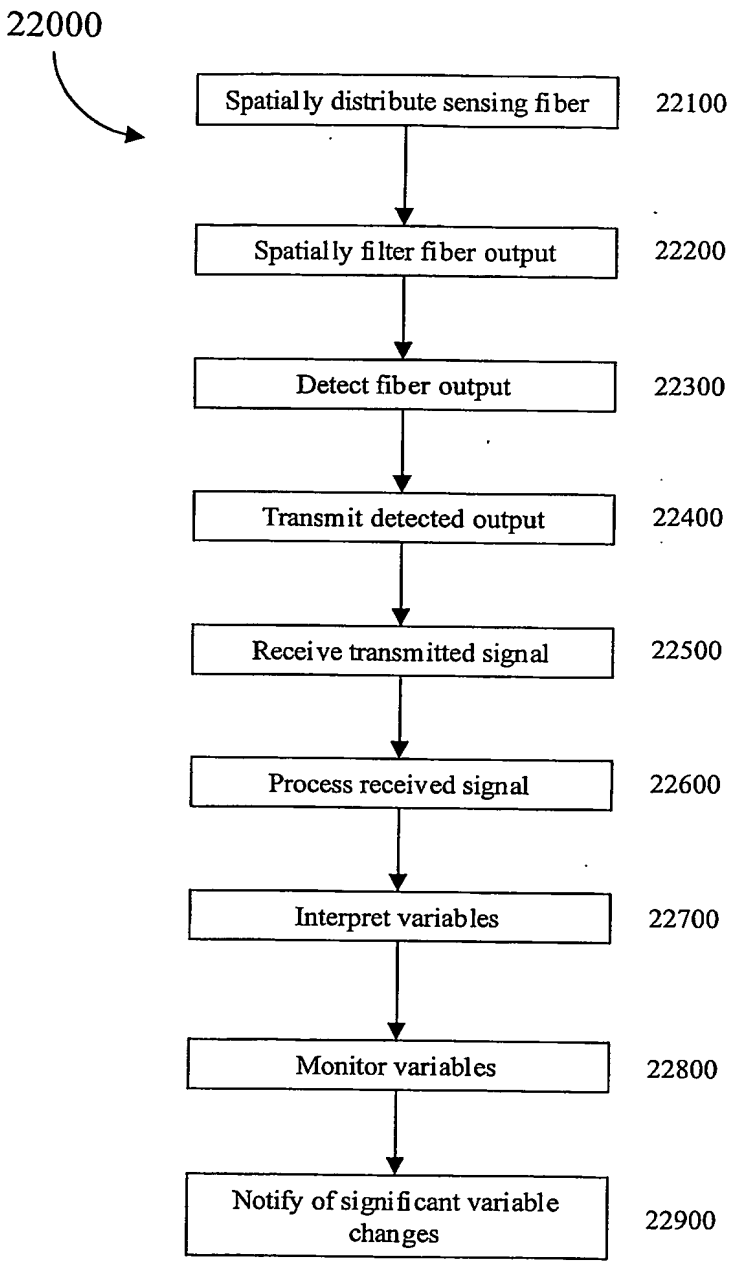

22000
Spatially distribute sensing fiber
22100
Spatially filter fiber output
22200
Detect fiber output
22300
Transmit detected output
22400
Receive transmitted signal
22500
Process received signal
22600
Interpret variables
22700
Monitor variables
22800
Notify of significant variable changes
22900

Fig. 22

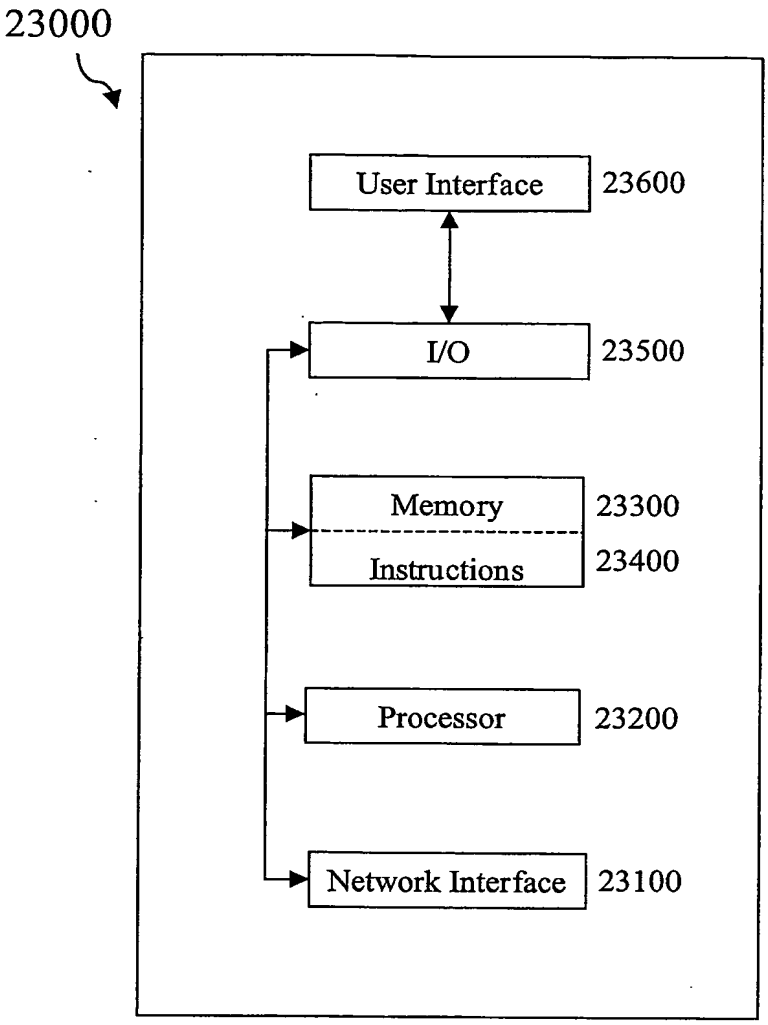

23000
User Interface
23600
I/O
23500
Memory
23300
Instructions
23400
Processor
23200
Network Interface
23100

Fig. 23

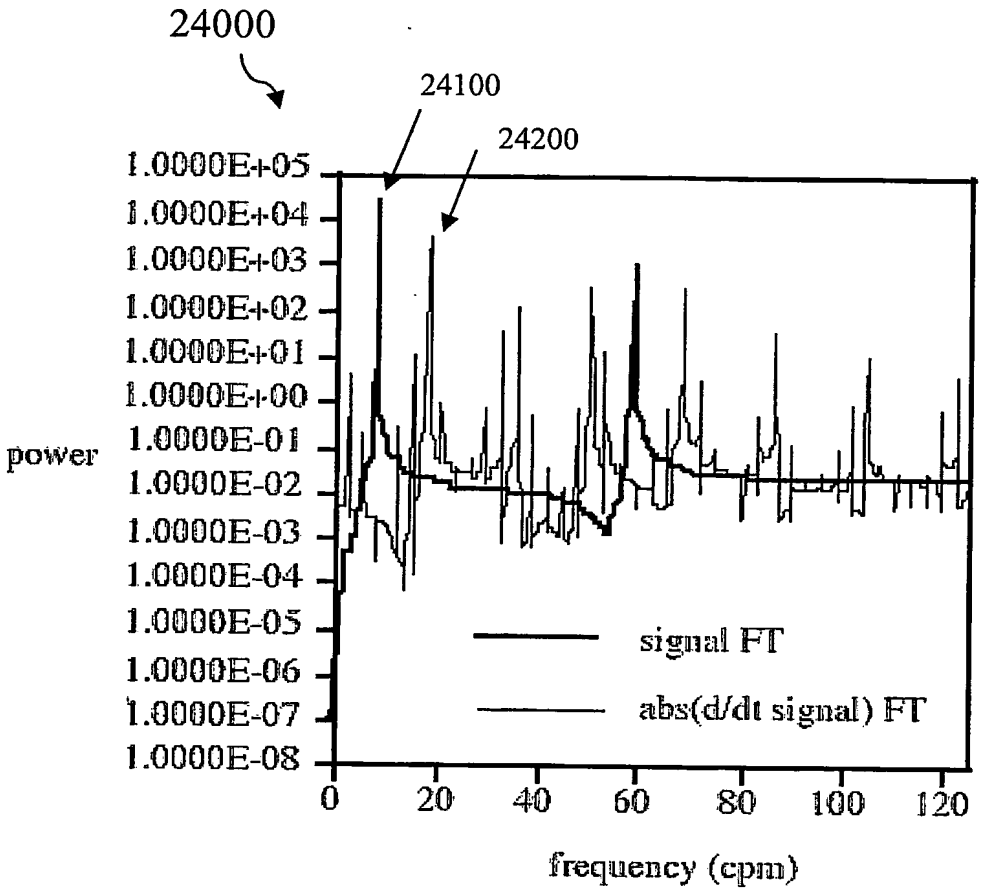

24000
24100
24200
1.0000E+05
1.0000E+04
1.0000E+03
1.0000E+02
1.0000E+01
1.0000E+00
1.0000E-01
1.0000E-02
1.0000E-03
1.0000E-04
1.0000E-05
1.0000E-06
1.0000E-07
1.0000E-08
power
signal FT
abs(d/dt signal) FT
0
20
40
60
80
100
120
frequency (cpm)

Fig. 24

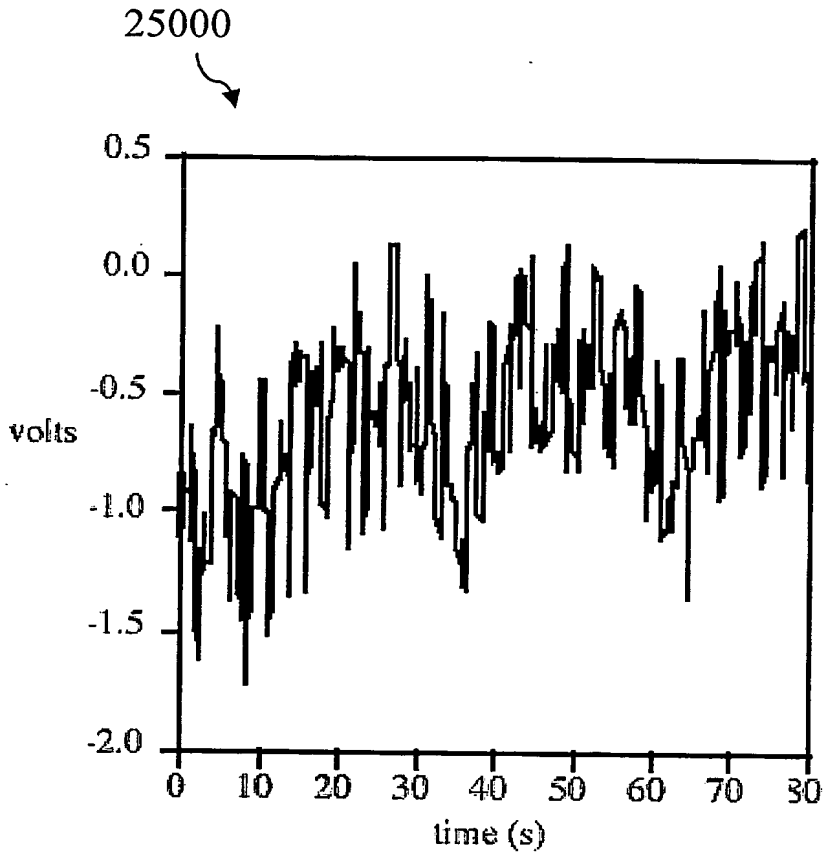


Fig. 25

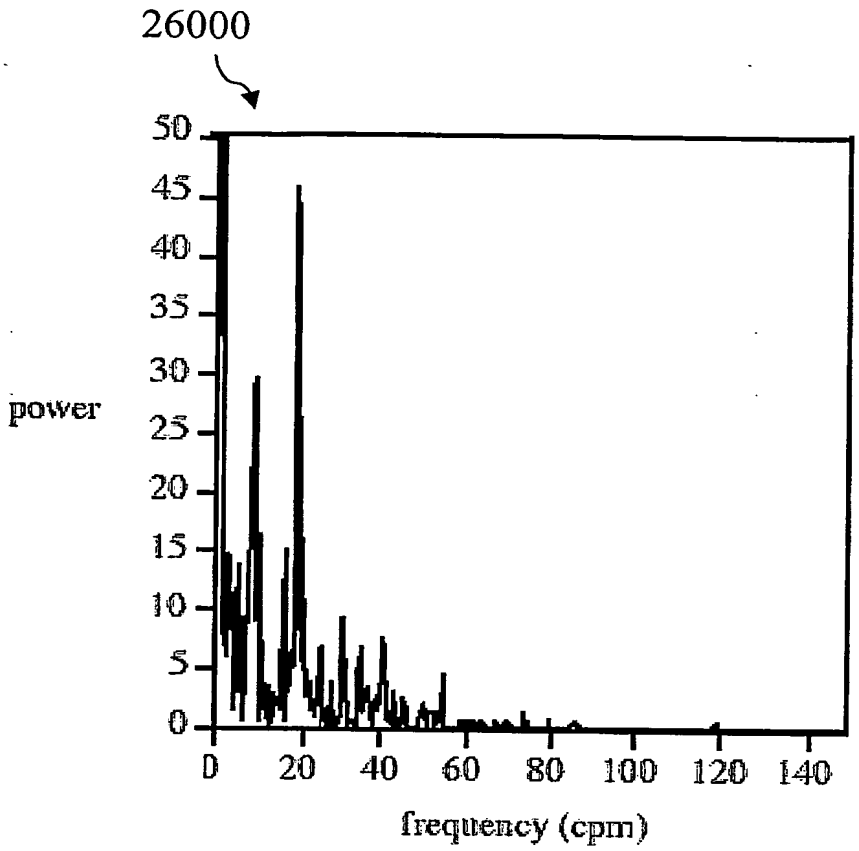

26000
50
45
40
35
30
25
20
15
10
5
0
power
0
20
40
60
80
100
120
140
frequency (cpm)

Fig. 26

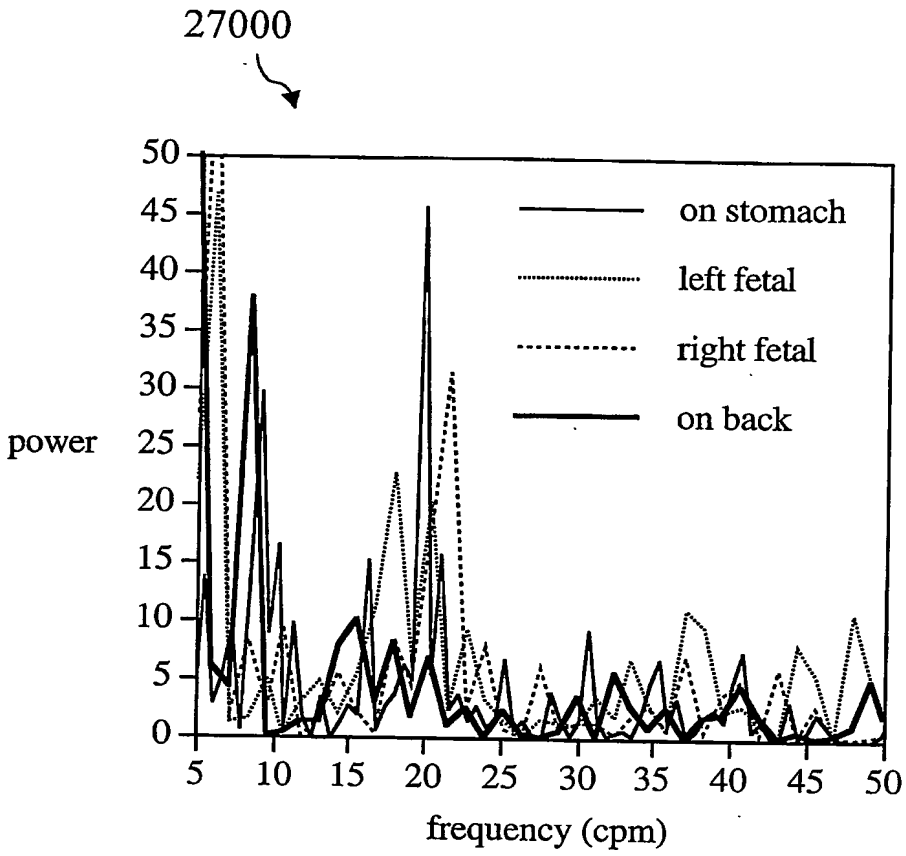

27000
50
45
40
35
30
25
20
15
10
5
0
power
5
10
15
20
25
30
35
40
45
50
frequency (cpm)
on stomach
left fetal
right fetal
on back

Fig. 27

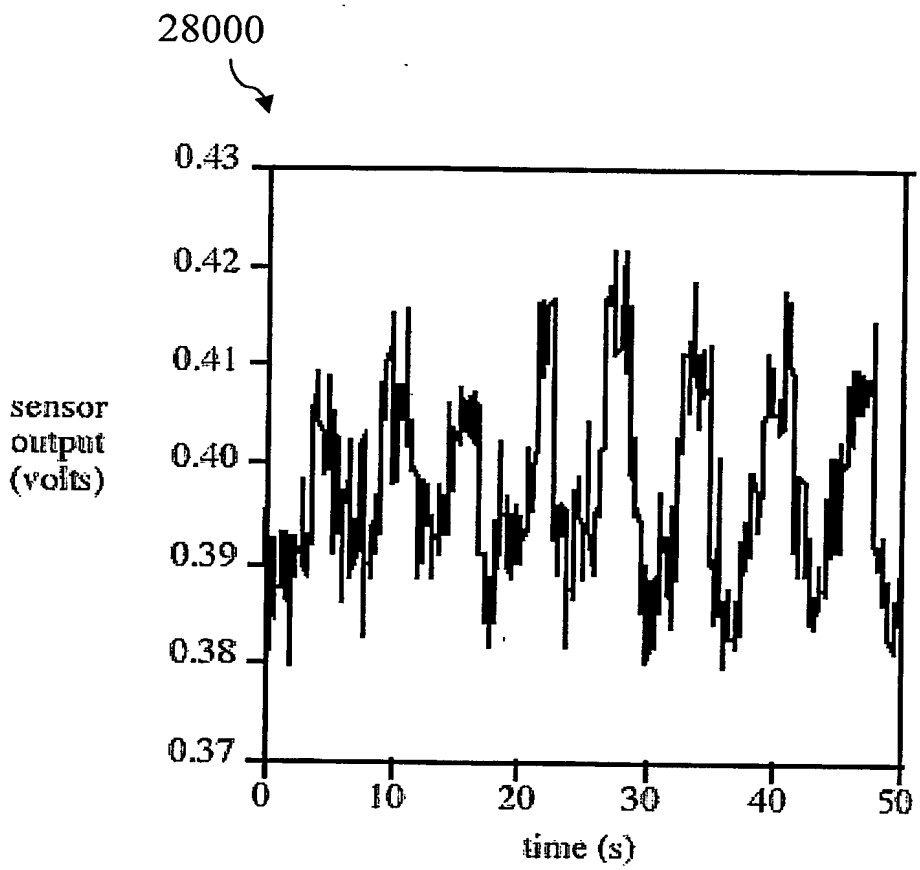

28000
0.43
0.42
0.41
0.40
0.39
0.38
0.37
sensor output (volts)
0
10
20
30
40
50
time (s)

Fig. 28

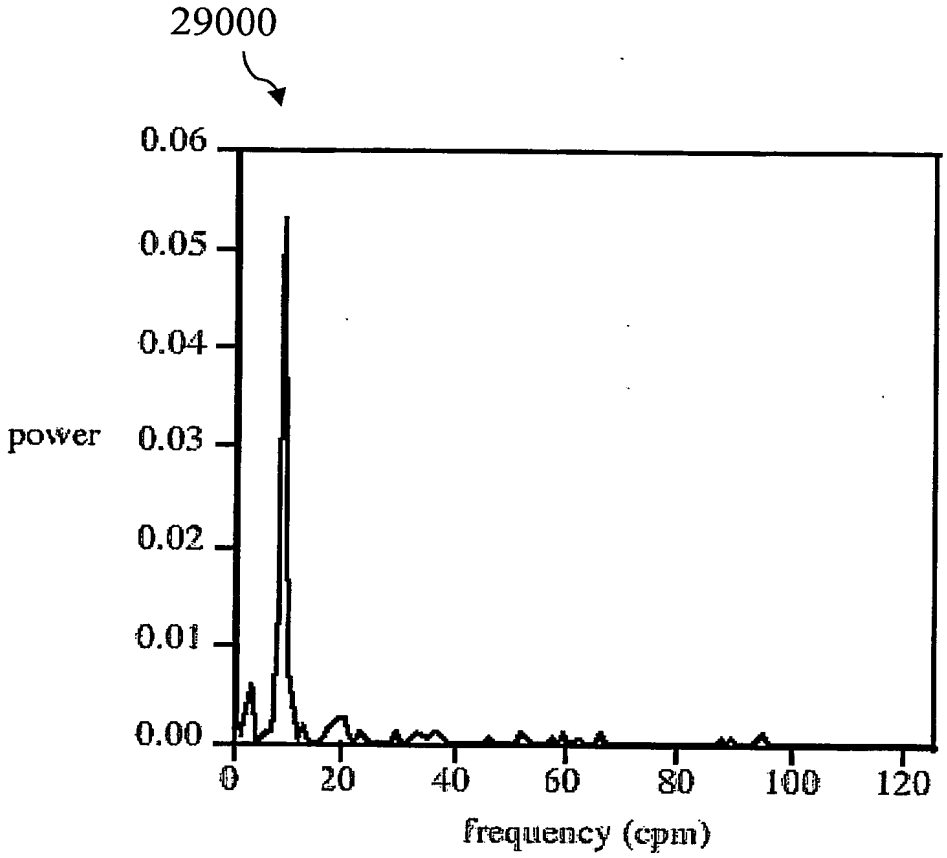

29000
0.06
0.05
0.04
power
0.03
0.02
0.01
0.00
0
20
40
60
80
100
120
frequency (cpm)

Fig. 29